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A Cost Analysis of a Community Health Worker Program in Rural Vermont

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Abstract

Studies have shown that community health workers (CHWs) can improve the effectiveness of health care systems; however, little has been reported about CHW program costs. We examined the costs of a program staffed by three CHWs associated with a small, rural hospital in Vermont. We used a standardized data collection tool to compile cost information from administrative data and personal interviews. We analyzed personnel and operational costs from October 2010 to September 2011. The estimated total program cost was $420,348, a figure comprised of $281,063 (67 %) for personnel and $139,285 (33 %) for operations. CHW salaries and office space were the major cost components. Our cost analysis approach may be adapted by others to conduct cost analyses of their CHW program. Our cost estimates can help inform future economic studies of CHW programs and resource allocation decisions.

Keywords

Community health worker; Program cost; Health care system

Introduction

The cost of treating chronic disease (e.g., hypertension, high cholesterol, diabetes, cancer, asthma, and depression) in the US has been estimated to account for over 75 % of national

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health expenditures [1]. As health care costs continue to rise, so does the need to contain costs by delivering health care services with greater efficiency. One way to do this is to make full use of health care extenders, such as community health workers (CHWs), who have been shown to help reduce healthcare costs [2–4].

Community health workers are trained to help people reduce their risk factors for disease, manage their chronic conditions, link them with local resources, and help them appropriately access the health care system [5]. CHWs are either paid or volunteer workers and typically share the same language, ethnicity, and life experiences of the communities they serve. Interventions carried out by CHWs have been shown to be effective in a variety of poor and underserved populations, including migrant farm workers and homeless people in the US [6, 7]. Moreover, a 2002 report by the Institute of Medicine recommended that CHWs be considered as a member of multidisciplinary health care teams to improve the delivery of care to underserved communities [8].

To date, several studies have demonstrated that CHW interventions can achieve cost savings for health insurers. In 2003, Fedder et al. [2] reported that visits to hospital emergency rooms and hospitalizations were reduced by 38 and 30 %, respectively, in conjunction with an intervention in which patients with diabetes and, in many cases, hypertension were supported and taught by CHWs. More recently, Johnson et al. [3], using a comparison group design for a Medicaid managed care population, examined an intervention for patients with chronic disease that involved the linking by CHWs of these patients to appropriate and accessible resources. The authors found a substantial reduction in the number of claims and payments for emergency room care, inpatient services, prescription drugs, and outpatient primary and specialty care. In another study involving Medicaid patients, specially trained CHWs in the Arkansas Community Connectors program identified patients at risk for nursing home care and linked them to home and community-based resources [4]. The authors reported a 23.8 % average reduction in annual Medicaid spending per participant over a 3-year period [4].

A few studies have reported some of the costs for CHW programs, but the cost information has been limited. For example, Primomo's 2006 investigation of a CHW asthma management program included labor, supplies, travel, and overhead, but it did not include costs related to training or workspace [9]. In a 2005 analysis by Elder et al. [10] of a nutrition program involving lay health advisors, the costs of mailings, supplies, personnel, travel mileage, and print material were factored into the analysis, but other operational costs such as equipment, workspace, and allocated overhead were not described. Table 1 summarizes some of the chronic diseases and populations studied in economic evaluations of CHW programs in recent decades.

At present, realistic, thorough estimates of the costs of CHW programs are needed to enable assessments of a program's cost-effectiveness. To help fill the gap, we conducted a detailed cost analysis of a CHW program in rural Vermont. Our comprehensive, systematic approach can be used by others to estimate their programmatic costs and serve as a foundation for future analyses of the cost-effectiveness of CHW programs. Costs analyses and other economic studies can provide decision makers with the information they need to determine

which programs under consideration are feasible to implement and which ongoing programs are feasible to maintain given the full range of program costs versus available resources. This paper describes the cost analysis conducted as part of the first phase of a comprehensive economic evaluation of a CHW program in St. Johnsbury, Vermont. Our approach of cost calculation for CHW programs can be adapted by other public health practitioners to examine program costs.

Background of CHW Programs

The importance of CHWs to help address issues related to the medically underserved was strengthened by the 2010 federal enactment of the Patient Protection and Affordable Care Act [11], which explicitly promotes the inclusion of CHWs as members of the health care team. As health care systems have become more complex, various CHW models have emerged such as peer health educators in faith-based settings, grassroots health promoters among migrant farm workers, or patient navigators who help cancer patients access and coordinate specialized care [12–14].

Although the stated goals of many CHW programs focus on improved clinical health outcomes and reduced economic costs, there is increasing recognition that social determinants of health, such as safety, shelter, personal relationships, and food security, have important impacts on clinical outcomes and long-term costs to society [15]. It has been hypothesized that by addressing social determinants of health as well as appropriate use of health care, a person's quality of life will be enhanced, the incidence and progression of chronic disease will be reduced, and cost savings can be achieved [16, 17]. Accordingly, some CHW programs are designed to directly address a patient's quality of life as a desirable outcome in addition to a broader aim to improve health and contain health care costs [18]. One such model that has been operating since 2007 is the Vermont Community Connections team CHW model implemented at the 25-bed Northeastern Vermont Regional Hospital. CHW Program of the Northeastern Vermont Regional Hospital Service Area.

Approximately 65 % of Vermonters lived in rural areas in 2011 and according to the US Census Bureau, 95.3 % of the state's population is white; 1.0 % is Black/African American; 1.3 %, Asian; and 1.5 % of Hispanic/Latino origin [19, 20]. The Northeastern Vermont Regional Hospital (NVRH) geographic service area is comprised primarily of Caledonia County and the immediately surrounding cities and townships (see Fig. 1). In 2010 the poverty level for Caledonia County was 13.5 % (vs. 11.1 % in Vermont), and its unemployment rate was 7.3 % (vs. 6.0 %) [20, 21]. Fourteen percent of Caledonia residents are uninsured [22]. Caledonia County residents have higher rates of adult diabetes in comparison to the Vermont population [Caledonia, 7.9 %; Vermont, 6.8 % (US rate is 8.7 %)] or adult obesity [Caledonia, 26.2 %; Vermont, 23.4 % (US rate is 29.3 %)], but a slightly lower rate for hypertension mortality per 100,000 population (Caledonia, 135.5; Vermont,139.9) [22–24]. The state of Vermont ranks second in the US for rate of adult asthma (14.9 %), far above the national rate of 8.5 % but still lower than the rate for Caledonia County (17.9 %) [20, 22].

The Community Connections (CoCo) team of NVRH focuses on improving the quality of life of all 27,000 residents in the hospital service area. When state-level legislation enacted

in 2008 created financial support for piloting community health team (CHT) models, a form of team-based care, the NVRH service area was selected as one of the three pilot sites. CoCo became the cornerstone program for the CHT in the NVRH service area. The CoCo model, however, differed from the other two pilot sites because it included CHWs who were intentionally integrated into a larger CHT that currently includes physicians, nurses, behavioral health specialists, chronic care coordinators, dieticians, and other health care professionals. From 2008 to the present, the CoCo program has been funded by NVRH and by contributions from government and private third party insurance payers who are legislatively mandated to support CHTs in the state.

The NVRH CoCo team consists of three full-time CHWs; a supervisor who spends 70 % of her time on CoCo supervision and CHW services and 30 % on the CHT; and a hospital vice president who spends 20 % of her time on administrative oversight. The CHWs are knowledgeable about resources in the local area and receive additional training to help program participants in accessing social and economic services to improve their life conditions. CHWs meet individually with each participant and link them to community services such as food pantries, programs to provide heating assistance during the winter, or legal aid. CHWs also help participants enroll in Vermont's health insurance program, gain access to a primary health care provider, and, if needed, arrange for transportation to medical appointments. Once the conditions affecting a participant's life are stabilized, CHWs continue to work with participants to increase their skills in managing their health conditions and their motivation to engage in healthy behaviors. The premise of the CoCo program is that stabilizing the life conditions of participants can reduce costs by mediating problems with a participant's conditions of life that affect well-being and contribute to illness and utilization of health care. By meeting basic needs, patients' risk for ill health is decreased, they are able to seek routine health care, comply with their physician's recommendations, and enjoy an improved quality of life. In turn, cost savings for the health system are achieved because of a reduction in urgent health care services such as emergency room visits, accomplished in part by the early detection and effective management of chronic diseases.

Methods

Data Collection

Our data collection team consisted of a program evaluator, a health economist, a hospital administrator, and a health scientist. We collected cost data on the CoCo team for the period of October 1, 2010, through September 30, 2011, using an information collection tool that we created. In developing the tool we scanned the literature and relevant documents to identify cost categories used by previous researchers. Second, we conducted a 2-day site visit, inperson and telephone interviews with CoCo staff and reviewed program documents to further develop our list of potential cost categories for the program. Then, using the information collection tool, the hospital administrator compiled the data for the analysis by examining the hospital's financial records and speaking directly with CoCo team members. Finally, the data collection team met to discuss the data obtained and determine what additional information was needed to complete the data collection process.

The original data sources for our study included financial records, such as the general ledger and subsidiary journal from the hospital's finance department, and official documents that described expenditures (Table 2). We used two categories of cost-related data elements: (1) personnel involved in the CoCo team (elements included number of persons, salaries, and fringe benefits, time spent on CoCo team activities, and overhead); and (2) items related to operational activity (including the cost of start-up-related equipment and activities; direct program operation such as office space, mileage, educational material; and training of the CoCo team members).

Time Study

Although information on salary and fringe benefits was available from the hospital accounting system, the proportion of each staff member's time allocated to CoCo team-related duties was not known. Therefore, we conducted a study to determine the time that should be allocated to the CoCo program for each CHW, the CHW supervisor, the project director, and volunteers. With the input of the CHWs, we developed a form that listed the duties of CHWs, such as meeting with patients, documenting patient information, and participating in training or professional development. For a 2-week period, each CHW checked off the category that reflected her/his activity for each 30-min increment of the workday.

Cost Calculation

We assessed the program cost from a public health perspective. This perspective is used to determine how much funding the public health system needs to set up and operate a program. This was chosen rather than the societal perspective, which is often employed in cost-effectiveness studies, because in studies using that perspective, costs associated with program participants (e.g., time spent, travel expenses, child care while participating, enrollment fees) are included as program costs. Although this paper does not address cost-effectiveness, the intended impact of CHW programs, including the CoCo team, is to improve the cost-effectiveness of public health care systems; thus, the public health perspective is relevant for evaluating the program's cost [25]. In this study, we calculated the program costs separately for personnel (labor) and operational (capital) costs as detailed in Table 3.

The personnel category included salary and benefits of personnel devoted to the CoCo activities (CHWs and supervisory and administrative staff). For full-time CHWs, the cost was their 1-year salary and fringe benefits (38 % of salary). For part-time personnel, we used information from the time study to allocate the percentage of each person's time devoted to the CoCo program and multiplied that by the person's 1-year salary and fringe benefits. The total for wages and benefits was multiplied by 10 % for overhead charged by the NVRH to cover personnel administration, information technology, and other administrative services. To derive the value of volunteers' work, we multiplied the number of hours devoted to the CoCo activities by the 2011 minimum hourly wage in Vermont ($8.15/h).

The operational category included the expenses of program start-up, the direct program cost, and workforce development, including staff training. For the direct program cost, we separated office space from other CHW-related costs in our presentation (Table 3) because the office space was the largest cost item for the program. For professional development activities, we used a 1-year cycle of CHWs' attendance at conferences, in-service trainings, and conferences, and we tabulated the registration fees and travel expenses for all CoCo staff members.

The NVRH provides office space and overhead to the CoCo team at no charge to the program. To determine the value of the office space, we obtained a floor plan of the team's workspace and calculated a rate for office space per square foot using the 2011 average value of commercial real estate property in the area of the NVRH by using data from local real estate listings [26].

Sensitivity Analysis

Because many factors (variables) that influence program costs may change over time and vary across communities, sensitivity analyses are useful in understanding the robustness of the cost calculations for a specific program. Accordingly, we calculated the program costs using two scenarios: a most-expensive case and a least-expensive case. To do this we first identified those major cost components of the program that are likely to change over time and to vary across communities. For the CoCo program, the largest component in the personnel category was CHW salaries and benefits; in the operational category, the largest component was rental fee of office space, and thus used these variables for our sensitivity analyses. For personnel costs, we also included volunteer time, as these costs are likely to vary in different settings. For operational costs, we also included training in the sensitivity analyses because almost half of the trainings in our original analysis did not incur costs such as travel and registration.

For the most-expensive case, we calculated costs for all three CHWs based on the highest salary level in our estimate of program costs, and volunteer time was valued at the CHW salary level. For operational costs in this scenario, we calculated office space costs at 133 % of our program cost estimate, and we recalculated the cost of free or in-service training events by assigning them a cost that was the average expense for the non-free trainings. For the least-expensive scenario, we used the lowest salary level of the three CHWs, volunteers got no pay, and we reduced the costs for office space by one-third. Using these values, we calculated the program costs for the two scenarios respectively.

Results

The total 1-year cost of the program was estimated to be $420,640 of which 67 % was for personnel and 33 % for operations. The estimated program cost per CHW is $140,116. The total personnel cost of the program (including the 10 % added for overhead) for 1 year was $281,063. Before adding the 10 % overhead, the cost for personnel was $255,512, with 58 % of this cost being for CHWs and just 3 % for volunteers (Table 3). The total operational cost was estimated to be $139,577, with 81 % of that figure for office space, 12 % for daily

operational activities and 3 % for training and professional development expenses. Start-up costs accounted for 4 % of the operational costs.

The sensitivity analysis indicated that the 1-year program cost might be as high as $485,373 or as low as $364,560 (Table 4). For the most-expensive case, 63 % ($305,472) of the 1-year program cost was for personnel and the remaining 37 % ($179,901) for operations. For the least-expensive case, the proportion represented by personnel expenditures increased to 72 % ($262,483), and the proportion for operational cost was reduced to 28 % ($102,077).

Lastly, in a real-world scenario for the CoCo program, where all in-kind supports (overhead for personnel, office space, and the time of volunteers) were not counted as program costs, the analysis found that the total program costs could be as low as $274,447 ($248,495 [91 %] for personnel and $25,952 [9 %] for operations [see note 3 in Table 3]).

Discussion

In this study, we identified relevant cost items to calculate the 1-year (October 2010 through September 2011) cost of the CoCo program in rural Vermont, which is affiliated with a small regional hospital. In estimating the total cost, we examined its two main components: personnel and operations. Although in recent years many researchers have studied the cost-effectiveness of CHW programs, limited reports on the full range of program costs have been published [2, 3, 27, 28]. Further, even though there have been studies that focused primarily on program costs, very few studies provided a comprehensive analysis of those costs [9, 10, 29, 30].

Using the methods described, our study might be the first to conduct a full, comprehensive assessment of a CHW program's cost based on itemized items from actual financial records for the program. Program costs can be categorized and analyzed in various ways. Conventionally, economists categorize costs as "fixed" and "variable"; unlike variable costs, fixed costs do not vary with the amount of output produced or work performed. In the long run or as a program expands, virtually all costs are variable, making it hard to distinguish between fixed and variable costs. Another way economists categorize costs is to treat them as "labor" (personnel) or "capital" (money). Although labor costs ultimately requires capital/money to pay for salaries and benefits, capital costs are often referred to as those needed for program operation. We assessed personnel and operational costs separately and included further details by using sub-categories. This approach reflects the real world implementation of the Vermont CHW program.

A strength of our cost analysis is the time study we conducted to obtain a better understanding of the activities of the CoCo team personnel, allowing us to accurately estimate the labor cost associated with all of the personnel. Furthermore, recommendations from systematic reviews have emphasized the need for continuous training of CHWs [5, 31]. This study's inclusion of training costs helps to estimate the associated costs of training CHWs. Lastly, we explored the sensitivity of the program cost in relation to the personnel costs of CHWs and volunteers and the operational cost of office space and training. At the

lower funding level that we explored, the personnel cost accounted for a larger component of the program's cost than was the case using the higher funding level.

The strategies that we employed should make our results more accurate than studies that used generalized estimates. Our approach may also serve as a useful approach and a helpful reference for others seeking to conduct a systematic cost analysis of their programs. The cost categories (e.g. personnel, training, start-up costs) that were systematically identified and the data sources that were used for accessing cost data may be considered by program administrators who are interested in conducting a similar assessment for their CHW program. This information will be especially useful to those who are developing CHW programs under various financial situations.

Limitations

Our study has several limitations that should be considered in interpreting our results. First, although we systematically explored and collected very detailed cost-related items through actual financial records, a site visit, and several personal interviews with CHWs and supervisory and administrative staff, these items were recorded in the routine performance of business and not specifically for our cost analysis. Second, the identification of relevant costs was not begun before the study. Ideally detailed cost information should be collected and recorded systematically alongside with the program development/implementation process. This enables economic evaluations including cost and cost-effectiveness analyses to be potentially more accurate and therefore more useful to policy makers regarding resource allocations [32]. Third, we evaluated the costs for a specific fiscal year that was arbitrarily selected, and the representativeness of that time period was not investigated. Cost estimates would be more robust if they were based on the average of multiple years. Similarly, because we did not find any studies in the literature that were comparable to our analysis, we are uncertain about whether our cost estimate will be generally consistent (after accounting for inflation) with other similar programs. We should also note that our cost estimates were higher than the cost required for operating the CoCo activities in the real world because we assigned values to all of the in-kind support and included these figures in our cost calculation.

Still, even considering the above limitations, we believe the approach used in this study to collect and evaluate cost-related data items and to estimate program costs will contribute valuable information to other investigators and practitioners seeking to enhance the efficiency of the public health system. That we performed sensitivity analyses should only increase the value of the present report.

Today, health care policy makers and other public health professionals frequently need programmatic cost data to make wise decisions in the allocation of scarce resources. Although our cost estimates were for a small CHW program in rural Vermont, the methods we used could be applicable to other communities. As health care administrators in the United States continue to search for improved effectiveness and efficiencies, CHW programs are being considered with new interest. Detailed cost analyses as described in this study can inform program planners as well as key decision makers. We recommend that more research in assessing program costs from the public health perspective be conducted as

a way of providing basic economic information for improving the effectiveness of that system.

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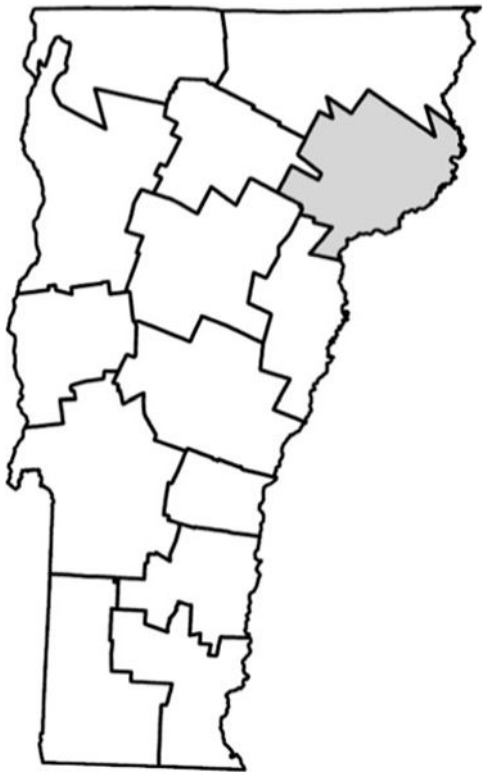

Fig. 1.

Northeastern Vermont Regional Hospital (St. Johnsbury) service area. Source: Vermont Blueprint for Health. 2011 annual report. Williston, VT: Department of Vermont Health Access, 2012

Table 1

Examples of public health issues, populations, and cost categories studied in the literature on CHWs, 1990–2012

Health conditions/topic areas	Populations	Cost categories
Asthma	Hispanics	Salaries/fringe benefits
Diabetes	Low-income families	Overhead
Cardiovascular disease/hypertension	Children with asthma	Travel
Substance abuse	Special populations (e.g., pregnant women)	Program costs
Nutrition	Elderly	Mailings
Mammography	Culturally diverse communities	Print materials
Mental health	Minority women	Incentives
		Operational costs
		Rent/workspace
		Office equipment/supplies
		Employee mileage
		Medical spending/health care utilization
		Medical supplies

Table 2

Cost categories, data sources, and cost assignments for the cost analysis of the CoCo program, St. Johnsbury, Vermont

Cost category	Data source	Cost assignment
Personnel		
CHWs	NVRH general ledger	Actual salary, time study
Supervisory staff	NVRH general ledger	Actual salary, time study
Volunteers	N/A	Bureau of Labor, time study
Administrative support (e.g., human resources, payroll, technology support)	NVRH general ledger	Standard NVRH overhead rate
Operational		
Start-up		
Office telephones	NVRH general ledger	Actual
Furniture (e.g., desks, chairs, tables)	NVRH general ledger	Actual
Computer equipment	NVRH general ledger	Actual
CHW recruitment	NVRH general ledger	Actual
Direct program cost		
Office space	NVRH floor plan	Commercial real estate averages
Program operational activities—mileage, promotional material, participant transportation, educational material, office supplies, utilities, IT support, and other miscellaneous costs	NVRH general ledger and subsidiary journal	Actual
Training/professional development	Training records	Local rate, national averages

CHWs community health workers, *NVRH* Northeastern Vermont Regional Hospital, *N/A* not applicable

Table 3

One-year program cost (in dollars) of CoCo team, St. Johnsbury, Vermont (October 2010–September 2011)

Personnel	Wages	Benefits	Total
Community health workers (n = 3)	106,995	40,658	147,653
Chronic integration coordinator (n = 1, 70 %)	53,475	20,320	73,795
Management leadership (n = 1, 20 %)	19,600	7,447	27,047
Volunteers (n = 2)	5,085	1,932	7,017
Subtotal	185,155	70,357	255,512
10 % overhead			25,551
Total personnel cost			281,063

Operational	Description	Cost
Start-up	CHW recruitment, furniture, computer, etc.	5,089
Direct program cost		
Office space (1,500 sf)	Rental fee	113,625
Program operation activities	Mileage, promotional material, participant transportation, education/marketing material, office supplies, utilities, IT support, etc.	16,801
Training (n = 4)	Registration fee and travel/lodging costs for attending training, conferences, networking, etc.	4,062
Total operational cost		139,577
Total program cost		420,640

(1) Total program cost: $420,640 [$281,063 for labor (66.8 %), $139,577 for capital (33.2 %)]

(2) The cost of volunteer labor was calculated using the 2011 minimum wage of $8.15 in Vermont. Office space was valued at the average commercial lease rate ($75.75/sf) in the area in 2011

(3) A real-world scenario based on no payment for volunteers and free in-kind support (no overhead for personnel, time of volunteers, and no payment for office space) indicated that the 1-year program cost (actual funds needed) could be just $274,447 [$248,495 for labor (90.5 %) and $25,952 for capital (9.5 %)]

IT information technology, *CHW* community health worker

Table 4

Sensitivity analysis of program cost of CoCo team, St. Johnsbury, Vermont, October 2010–September 2011

Items	Most-expensive case ($)	Least-expensive case ($)
Personnel		
Community health workers	163,613	137,779
Chronic integration coordinator	73,795	73,795
Management leadership	27,047	27,047
Volunteers	13,247	0
Subtotal	277,702	238,621
10 % overhead	27,770	23,862
Total personnel cost	305,472	262,483
Operational		
Start-up	5,089	5,089
Direct program cost		
Office space	151,125	76,125
Program operational activity	16,801	16,801
Training	6,886	4,062
Total operational cost	179,901	102,077
Total program cost	485,373	364,560
	62.9 % personnel	72.0 % personnel
	37.1 % operational	28.0 % operational

For the most-expensive case we used the highest salary for CHWs, volunteers got paid at the same wage rate as CHWs, rental for office space was increased by $25/sf (about one-third), trainings with no expenses (n = 7) were assigned a cost equal to the average expenses of those with expenses ($406). For the least-expensive case, we used the lowest salary for CHWs, volunteers got no pay, and the rental fee for office space was decreased by $25/sf (about one-third)